Local Data Storage and Offline Web Applications in Safari

Session 203

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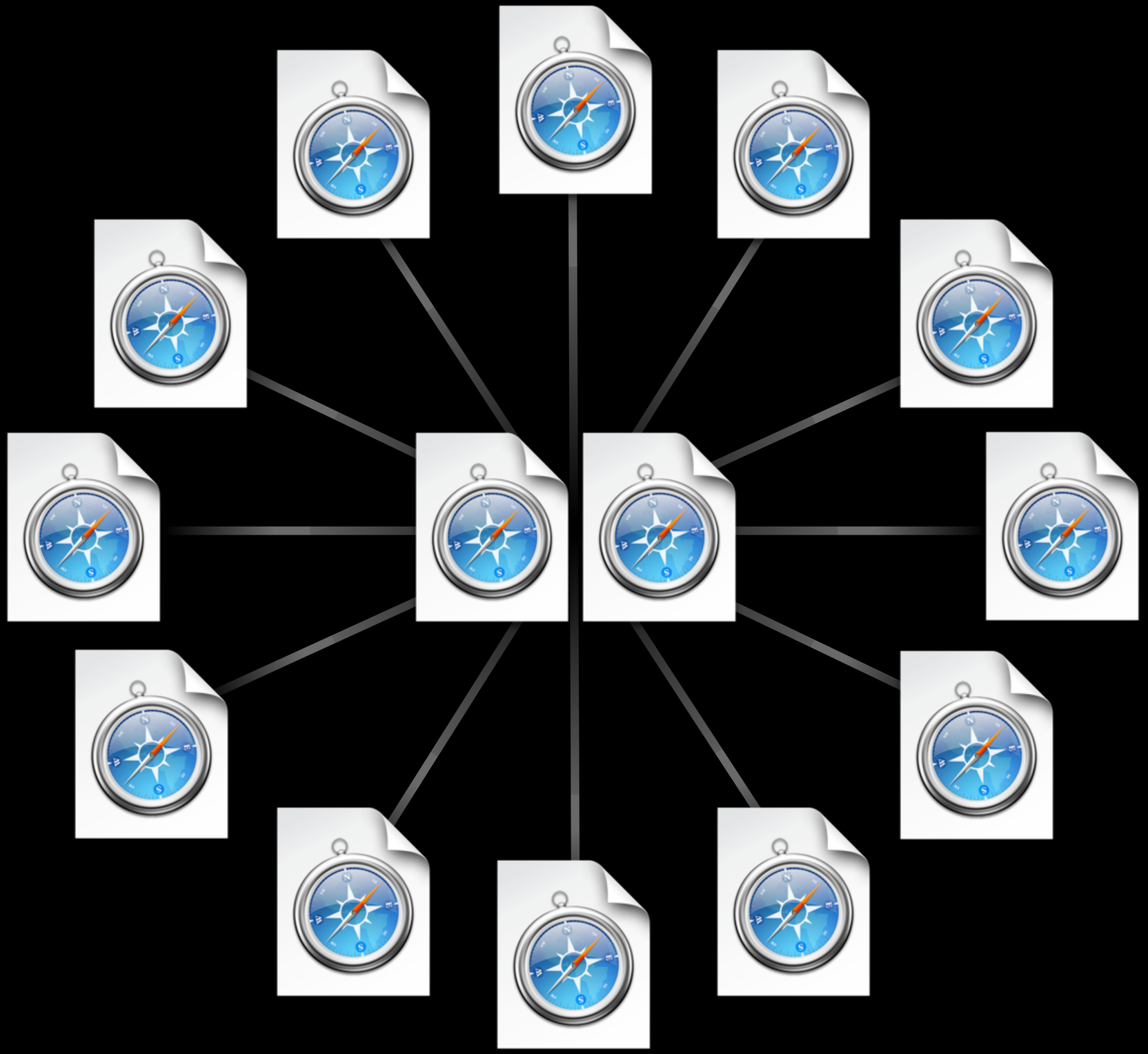
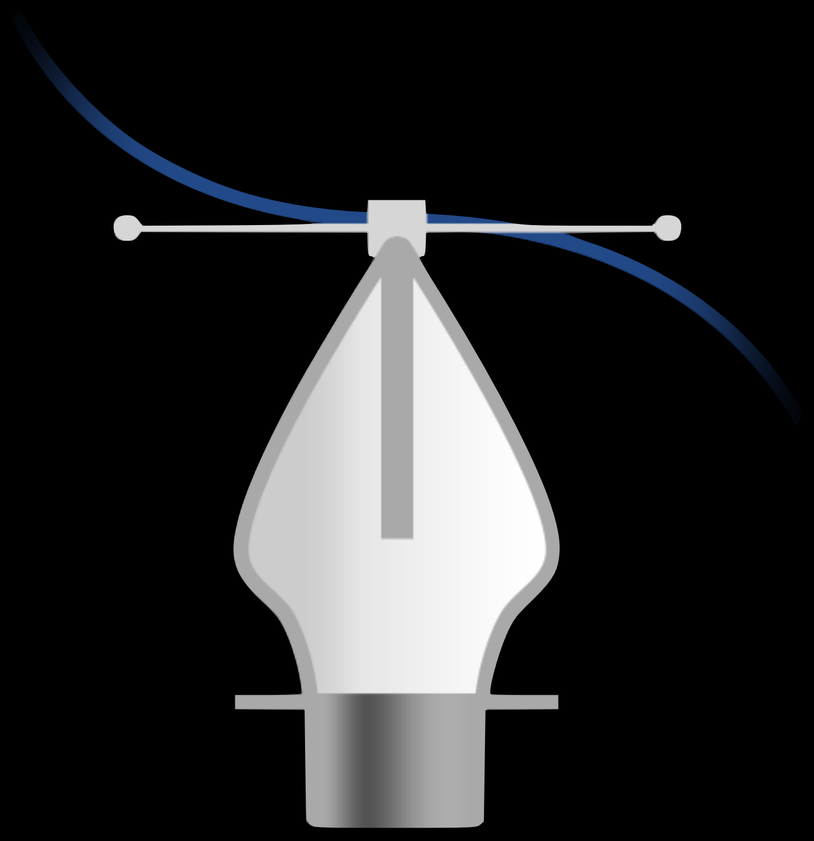
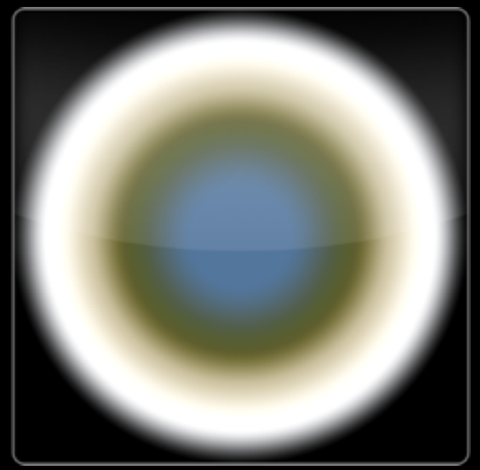
Local Data Storage and Offline Web Applications in Safari

Brady Eidson
Safari and WebKit Engineer







N
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S

But what about the data?

What Data?

- Your application's data
  - Application state
  - Application resources
- Your users data
  - Preferences and settings
  - User content

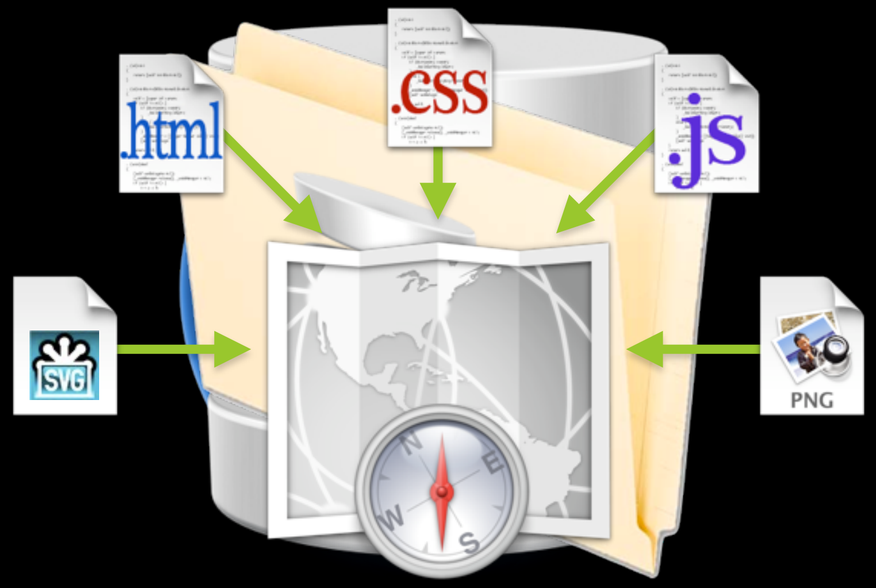
LOCAL

Web Standards
W3C
WHATWG
IETF

N
NE
NW
E
W
SE
SW
S

What We'll Talk About

- Data on the web
- HTML 5 key/value storage
  - SessionStorage
  - LocalStorage
- HTML 5 structured databases
- HTML 5 application cache



What We'll Talk About

- Data on the web
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What We'll Talk About

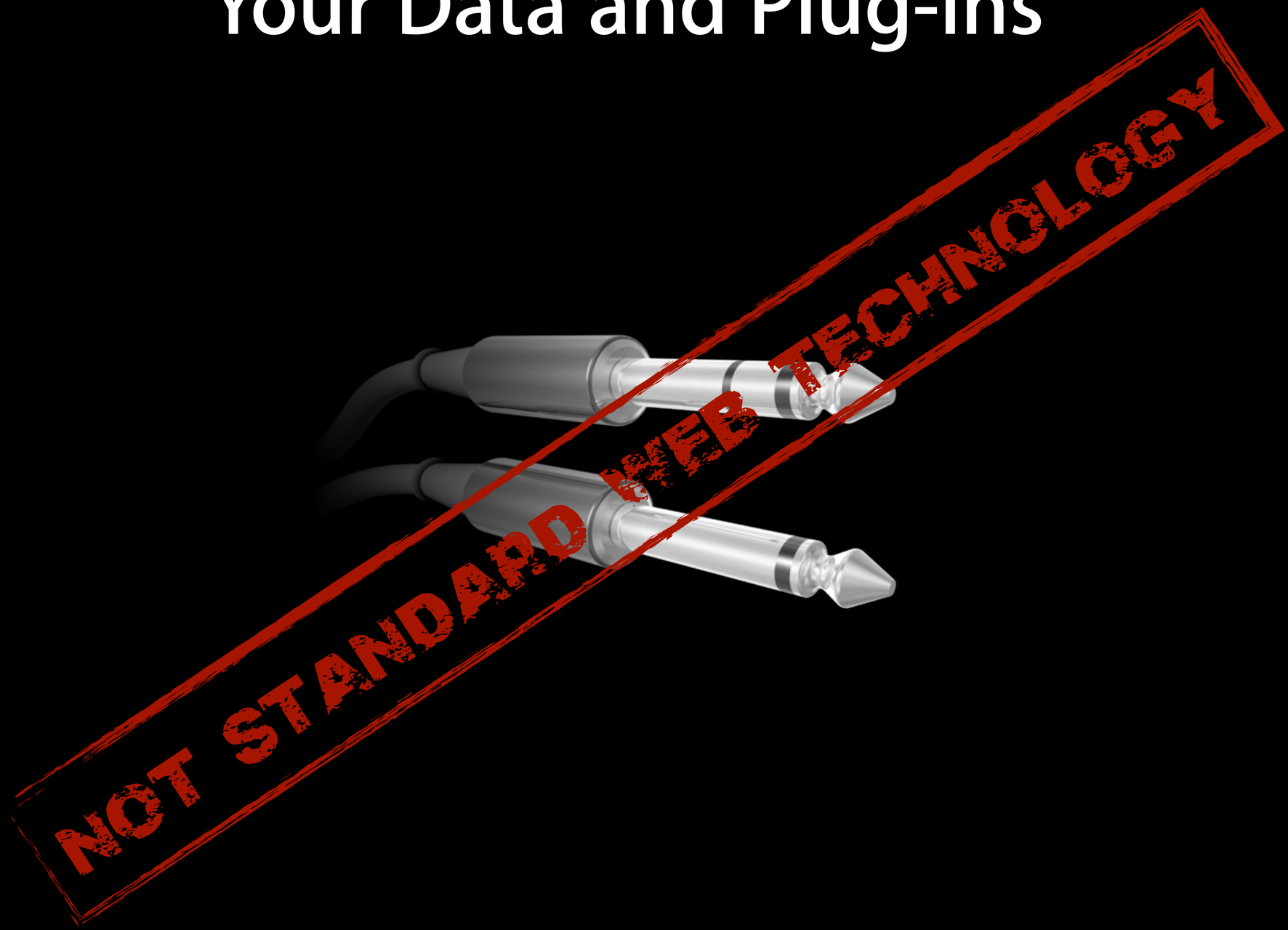
Data on the Web

- Data on the web
- HTML 5 key/value storage
  - SessionStorage
  - LocalStorage
- HTML 5 structured databases
- HTML 5 application cache

Your Data and Cookies

Your Data and the Cloud

Your Data and Plug-ins



Oh man, I never knew all of that!
What should I be looking for?

Simple Data

Complex Data

All Data

What We'll Talk About: Key/Value Storage

- Data on the web
- HTML 5 key/value storage
- HTML 5 structured databases
- HTML 5 application cache

Key/Value Storage

Overview

- Items are key/value pairs
- Simple to manipulate
- Origin-based security
- Two varieties
  - SessionStorage
  - LocalStorage
- Events

Key/Value Storage

Overview

- Items are key/value pairs
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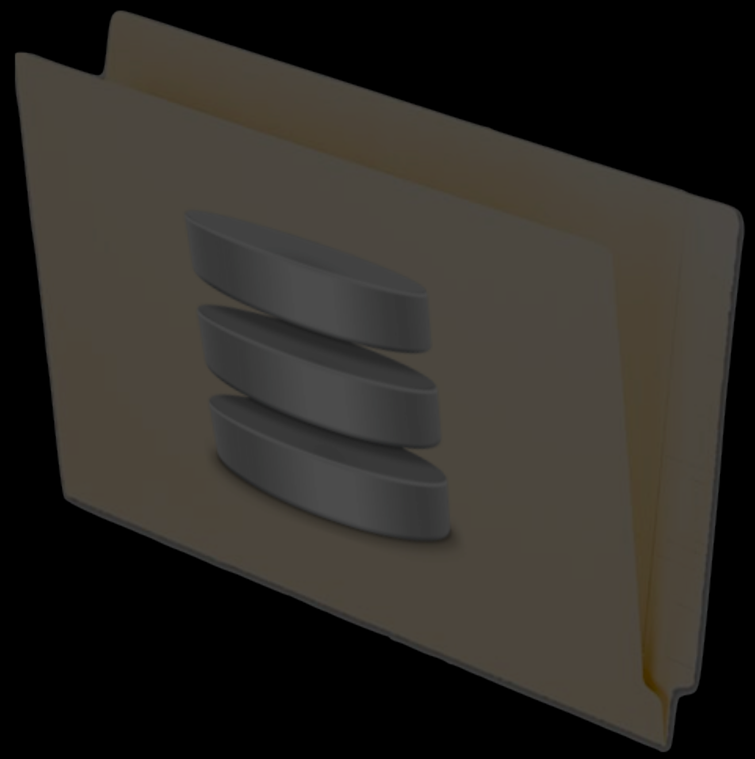
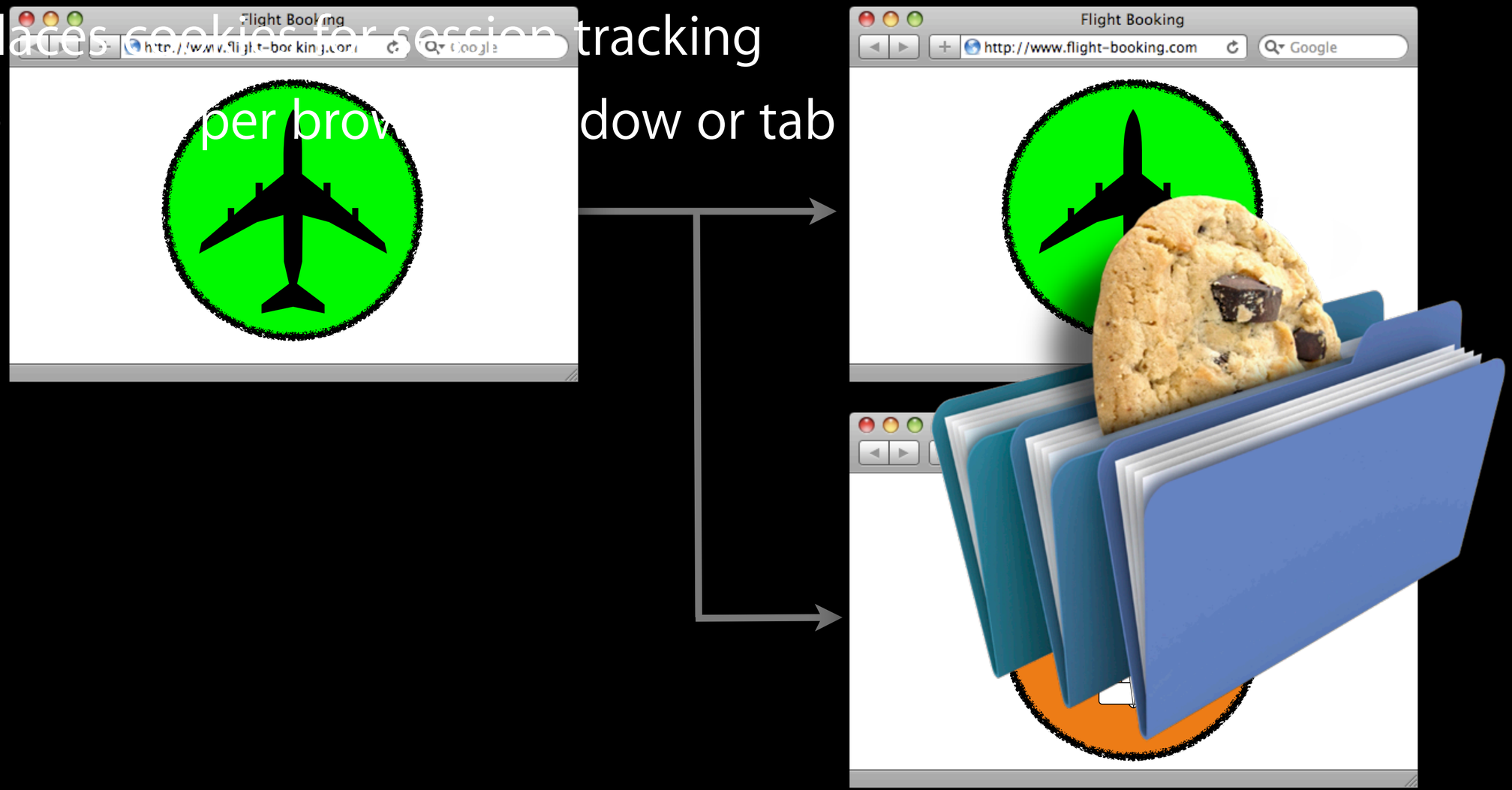
- Two varieties
  - SessionStorage
  - LocalStorage
- Events



SessionStorage

- Replaces cookies for session tracking
- One per browser window or tab



LocalStorage

- Persistent
- Global

Key/Value Storage

Setting an item

```
sessionStorage.setItem(‘flightID’, ‘1198:SFO-to-CDG’);
```

Key/Value Storage

Setting an item

```
sessionStorage.setItem(‘flightID’, ‘1198:SFO-to-CDG’);
sessionStorage[‘flightID’] = ‘1198:SFO-to-CDG’;
```

Key/Value Storage

Setting an item

```
sessionStorage.setItem(‘flightID’, ‘1198:SFO-to-CDG’);
sessionStorage[‘flightID’] = ‘1198:SFO-to-CDG’;
sessionStorage.flightID = ‘1198:SFO-to-CDG’;
```

Key/Value Storage

Getting an item

```
var value = sessionStorage.getItem(‘flightID’);
value = sessionStorage[‘flightID’];
value = sessionStorage.flightID;
```

Key/Value Storage

Iterating items

```
var value;
for (key in localStorage) {
    value = localStorage.getItem(key);
}
```

Key/Value Storage

Iterating items

```
var value;
for (key in localStorage) {
    value = localStorage[key];
}
```

Key/Value Storage

Removing items

```
sessionStorage.removeItem('flightID');
```

Key/Value Storage

Removing items

```
sessionStorage.removeItem('flightID');
delete sessionStorage.flightID;
```

Key/Value Storage

Removing items

```
sessionStorage.removeItem('flightID');
delete sessionStorage.flightID;
...
sessionStorage.clear();
```

Storage Events

Overview

- Keep tabs and windows in sync
- Sent when any item changes
- Sent to documents with the same origin
  - SessionStorage—Frames in the current page
  - LocalStorage—Every frame in every page

Storage Events

Getting them

```
function storageEventHandler() { ... }
...
window.addEventListener('storage', storageEventHandler, false);
```

Storage Events

Getting them

```
function storageEventHandler() { ... }
...
window.addEventListener('storage', storageEventHandler, false);
<body onstorage='storageEventHandler();'>
```

Storage Events

Using them

```
function handleStorageEvent() {
    event.key;
    event.oldValue;
    event.newValue;
    event.window;
    event.uri;
}
```

Storage Events

Using them

```
function handleStorageEvent() {
    event.key;
    event.oldValue;
    event.newValue;
    event.window;
    event.uri;
}
```

Demo

Checkers with LocalStorage

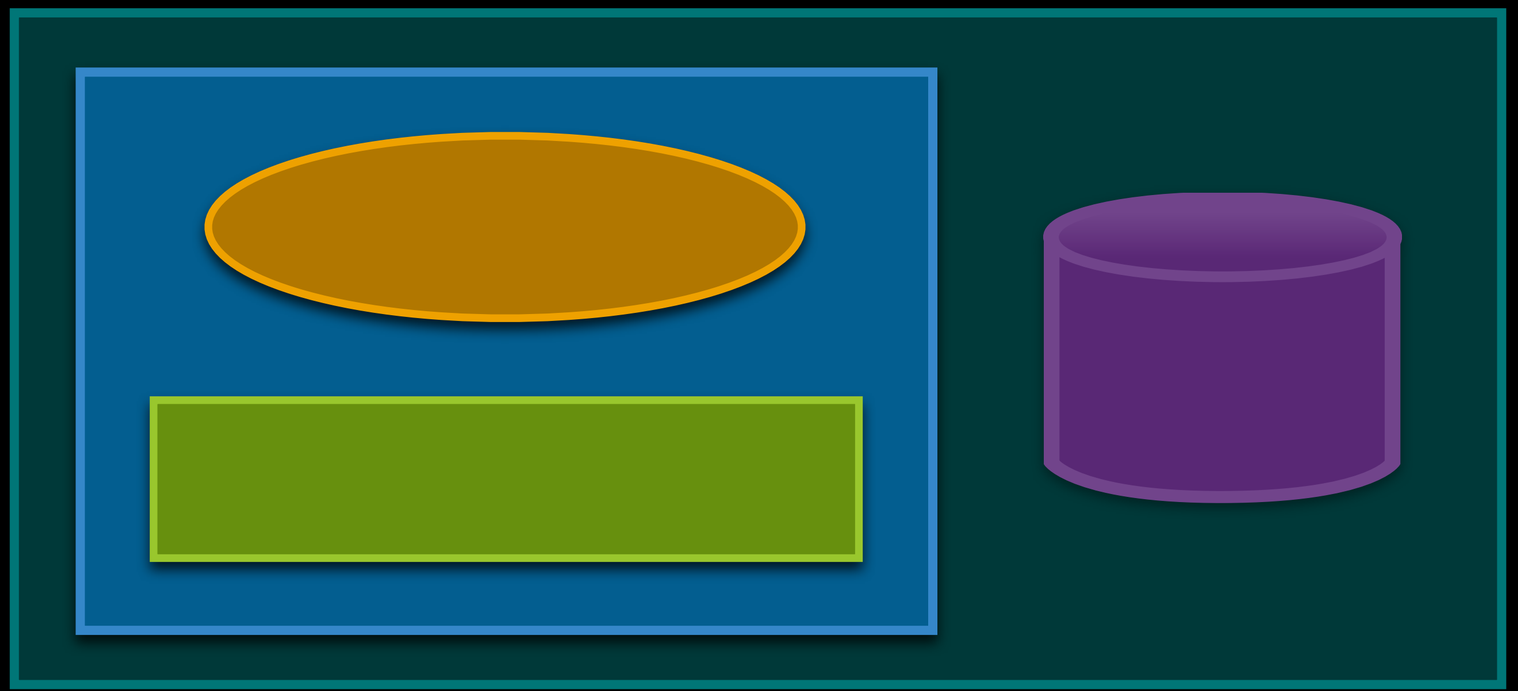
Beth Dakin
Safari and WebKit Engineer

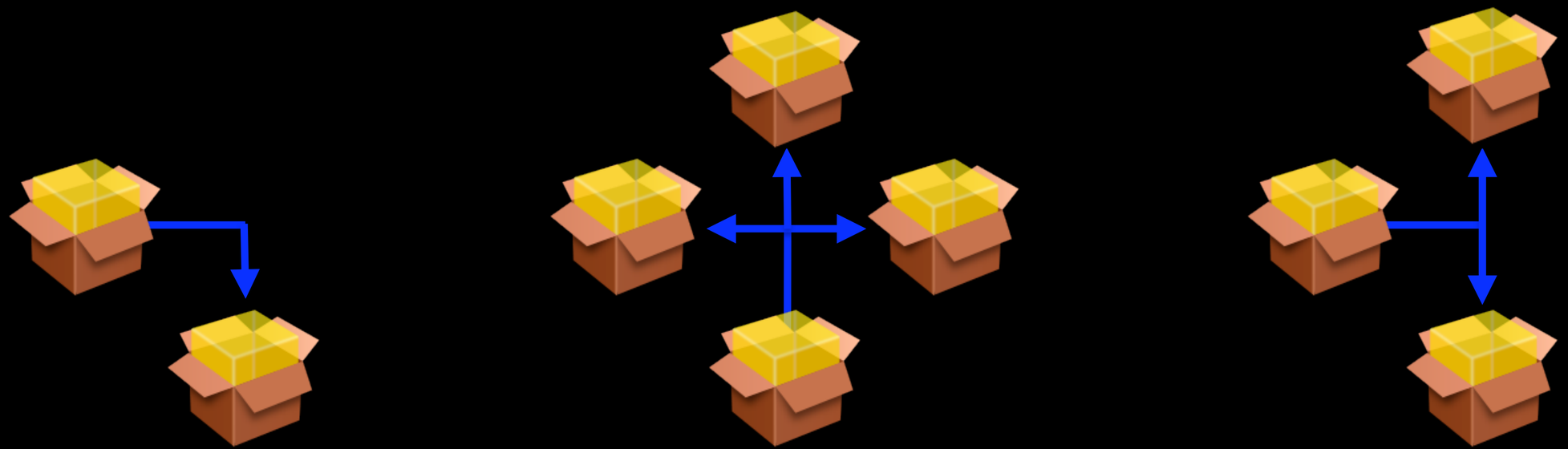
Key/Value Storage

Checkers demo

- Integrates in to the language
- Save application state locally

That’s great!
But what about my complex data?

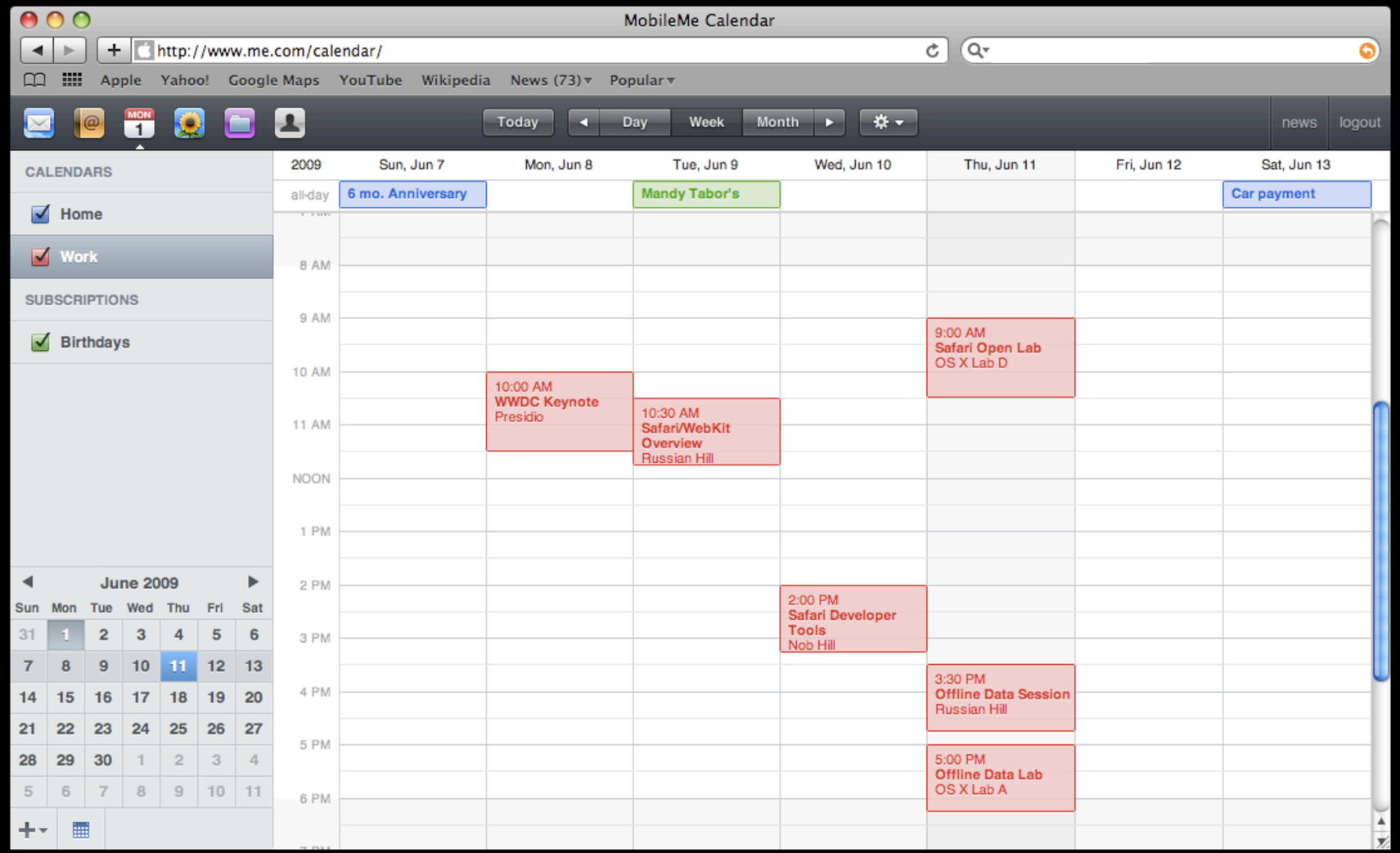


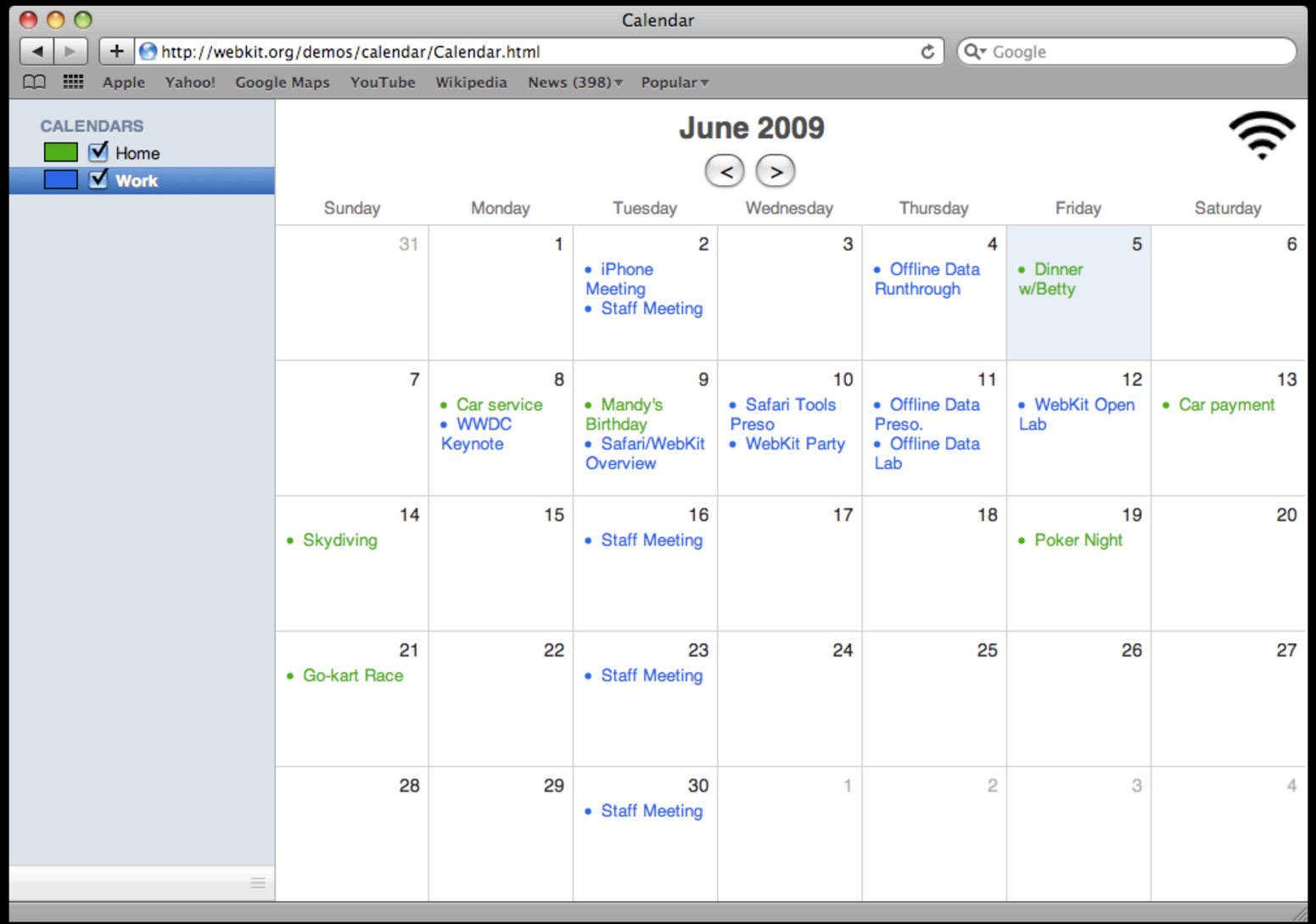


What We'll Talk About

Structured Databases

- Data on the web
- HTML 5 key/value storage
- HTML 5 structured databases
- HTML 5 application cache


MobileMe Calendar
http://www.me.com/calendar/
Apple
Yahoo!
Google Maps
YouTube
Wikipedia
News (73)
Popular
Today
Day
Week
Month
news
logout
CALENDARS
Home
Work
SUBSCRIPTIONS
Birthdays
June 2009
Sun Mon Tue Wed Thu Fri Sat
2009
Sun, Jun 7
Mon, Jun 8
Tue, Jun 9
Wed, Jun 10
Thu, Jun 11
Fri, Jun 12
Sat, Jun 13
all-day
6 mo. Anniversary
Mandy Tabor's
Car payment
8 AM
9 AM
10 AM
11 AM
NOON
1 PM
2 PM
3 PM
4 PM
5 PM
6 PM
9:00 AM
Safari Open Lab
OS X Lab D
10:00 AM
WWDC Keynote
Presidio
10:30 AM
Safari/WebKit
Overview
Russian Hill
2:00 PM
Safari Developer
Tools
Nob Hill
3:30 PM
Offline Data Session
Russian Hill
5:00 PM
Offline Data Lab
OS X Lab A


Calendar
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Google
Apple
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Google Maps
YouTube
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News (398)
Popular
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• Staff Meeting
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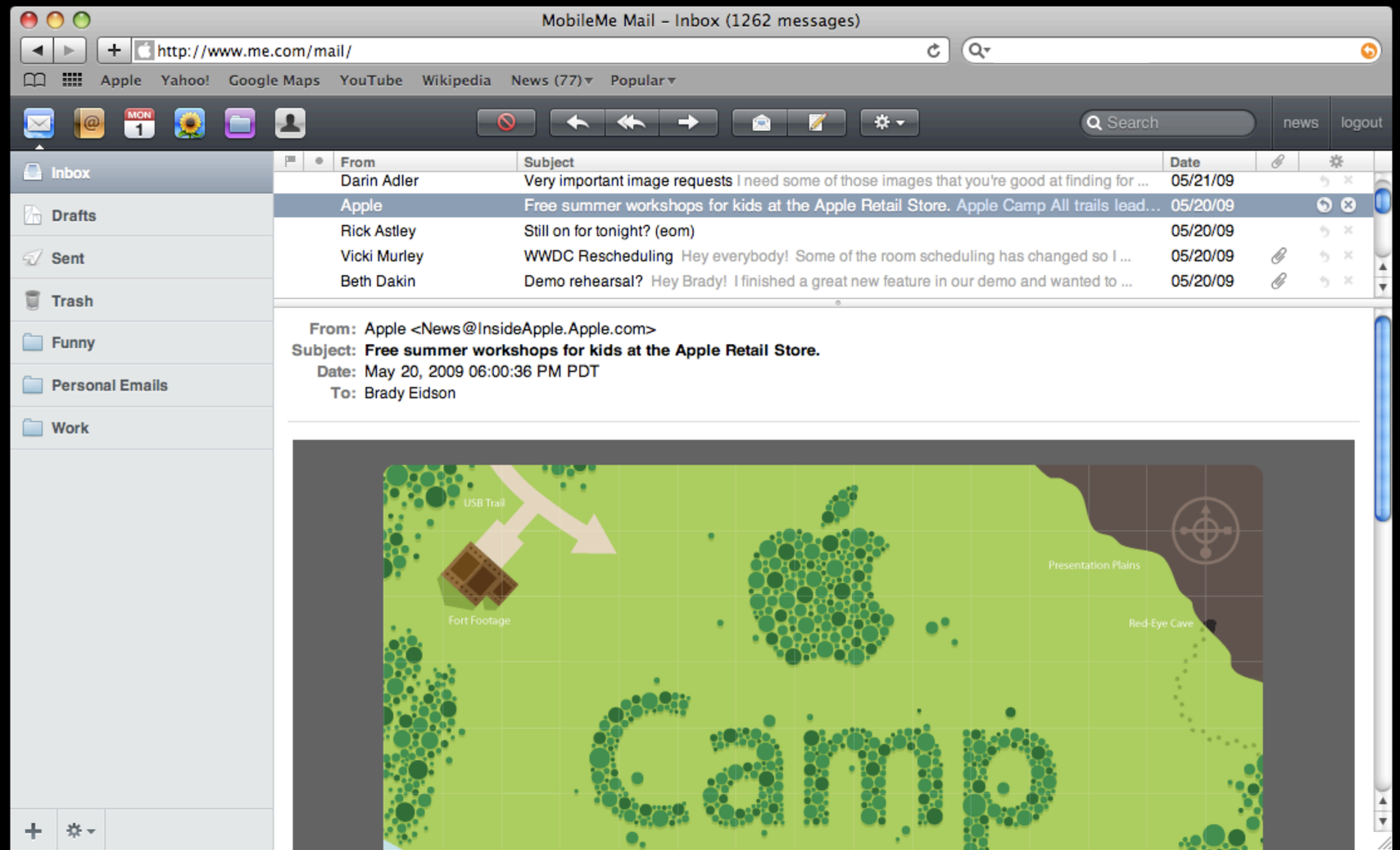
MobileMe Mail – Inbox (1262 messages)
http://www.me.com/mail/
Apple
Yahoo!
Google Maps
YouTube
Wikipedia
News (77)
Popular
Search
news
logout
Inbox
Drafts
Sent
Trash
Funny
Personal Emails
Work
From
Subject
Date
Darin Adler
Very important image requests I need some of those images that you're good at finding for ...
05/21/09
Apple
Free summer workshops for kids at the Apple Retail Store. Apple Camp All trails lead...
05/20/09
Rick Astley
Still on for tonight? (eom)
05/20/09
Vicki Murley
WWDC Rescheduling Hey everybody! Some of the room scheduling has changed so I ...
05/20/09
Beth Dakin
Demo rehearsal? Hey Brady! I finished a great new feature in our demo and wanted to ...
05/20/09
From: Apple <News@InsideApple.Apple.com>
Subject: Free summer workshops for kids at the Apple Retail Store.
Date: May 20, 2009 06:00:36 PM PDT
To: Brady Eidson
USB Trail
Fort Footage
Presentation Plains
Red-Eye Cave
Camp

Structured Databases

Overview

- Real-world SQL
- Asynchronous and callback
- Origin-based security

Structured Databases

Overview

- Real-world SQL
- Asynchronous and callback based
- Origin-based security

Tables

Rows of Data

Indexes

Triggers

Transactions…

…are built in

Structured Databases

Local advantages

- Works offline
- Performance
  - Speed
  - Responsiveness
  - Battery life
- Less complexity

MobileMe Mail – Inbox (1262 messages)

Search | news | logout

- Inbox
- Drafts
- Sent
- Trash
- Funny
- Personal Emails
- Work

From	Subject	Date
Darin Adler	Very important image requests I need some of those images that you're good at finding for ...	05/21/09
Apple	Free summer workshops for kids at the Apple Retail Store. Apple Camp All trails lead...	05/20/09
Rick Astley	Still on for tonight? (eom)	05/20/09
Vicki Murley	WWDC Rescheduling Hey everybody! Some of the room scheduling has changed so I ...	05/20/09
Beth Dakin	Demo rehearsal? Hey Brady! I finished a great new feature in our demo and wanted to ...	05/20/09

From: Apple <News@InsideApple.Apple.com>
Subject: **Free summer workshops for kids at the Apple Retail Store.**
Date: May 20, 2009 06:00:36 PM PDT
To: Brady Eidson

MobileMe Mail – New Message

To: Darin Adler

Cc:

Subject: Found the pictures you were looking for

Account: Brady Eidson

CuteKitten.png (90.0 KB)

CutePuppy.png (28.3 KB)

Attach another file… (19 MB remaining)

I know you said these were really important. Want me to keep sending more if I find them?

Brady

Structured Databases

Opening a database

```
var databaseName = "OfflineMail";
var version = "1.0";
var displayName = "Mail Message Database";
var expectedSize = 2500000;
...
var database = openDatabase(databaseName, version, displayName, expectedSize);
```

Structured Databases

Opening a database

```
var databaseName = "OfflineMail";
var version = "1.0";
var displayName = "Mail Message Database";
var expectedSize = 2500000;
...
var database = openDatabase(databaseName, version, displayName, expectedSize);
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Structured Databases

Opening a database

```
var databaseName = "OfflineMail";
var version = "1.0";
var displayName = "Mail Message Database";
var expectedSize = 2500000;
...
var database = openDatabase(databaseName, null, null, null);
```

Structured Databases

Starting a transaction

```
database.transaction(transactionCallback,
                     transactionErrorCallback,
                     completionCallback);

function transactionCallback(SQLTransaction tx)
{  ...  }

function transactionErrorCallback(SQLError error)
{  ...  }

function completionCallback()
{  ...  }
```

Structured Databases

Starting a transaction

```
database.transaction(transactionCallback,
                     transactionErrorCallback,
                     completionCallback);
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```
function transactionCallback(SQLTransaction tx)
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Structured Databases

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function transactionCallback(SQLTransaction tx)
{  ...  }
```

```
function transactionErrorCallback(SQLError error)
{  ...  }

function completionCallback()
{  ...  }
```

Structured Databases

Simple SQL statements

```
function transactionCallback(tx)
{
    var SQL = "CREATE TABLE OfflineMessages (id INTEGER,
               subject TEXT, recipient TEXT, body TEXT)";
    tx.executeSql(SQL);
}
```

Structured Databases

Simple SQL statements

```
function transactionCallback(tx)
{
    var SQL = "CREATE TABLE OfflineMessages (id INTEGER,
              subject TEXT, recipient TEXT, body TEXT)";
    tx.executeSql(SQL);
}
```

Structured Databases

Simple SQL statements—with arguments

```
function transactionCallback(tx)
{
    var SQL = "INSERT INTO OfflineMessages (id, subject, recipient, body)
               VALUES (?, ?, ?, ?)";
    tx.executeSql(SQL, [1, currentMessage.title, currentMessage.recipient,
                        currentMessage.bodyText]);
}
```

Structured Databases

Simple SQL statements—with arguments

```
function transactionCallback(tx)
{
    var SQL = "INSERT INTO OfflineMessages (id, subject, recipient, body)
               VALUES (?, ?, ?, ?)";
    tx.executeSql(SQL, [1, currentMessage.title, currentMessage.recipient,
                        currentMessage.bodyText]);
}
```

Structured Databases

Results and errors

```
tx.executeSql(SQLStatement, [arguments], StatementCallback, ErrorCallback);

function statementCallback(SQLTransaction tx, SQLResultSet result)
{  ...  }

function errorCallback(SQLTransaction tx, SQLError error)
{  ...  }
```

Structured Databases

Results and errors

```
tx.executeSql(SQLStatement, [arguments], StatementCallback, ErrorCallback);
```

```
function statementCallback(SQLTransaction tx, SQLResultSet result)
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function errorCallback(SQLTransaction tx, SQLError error)
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Structured Databases

Results and errors

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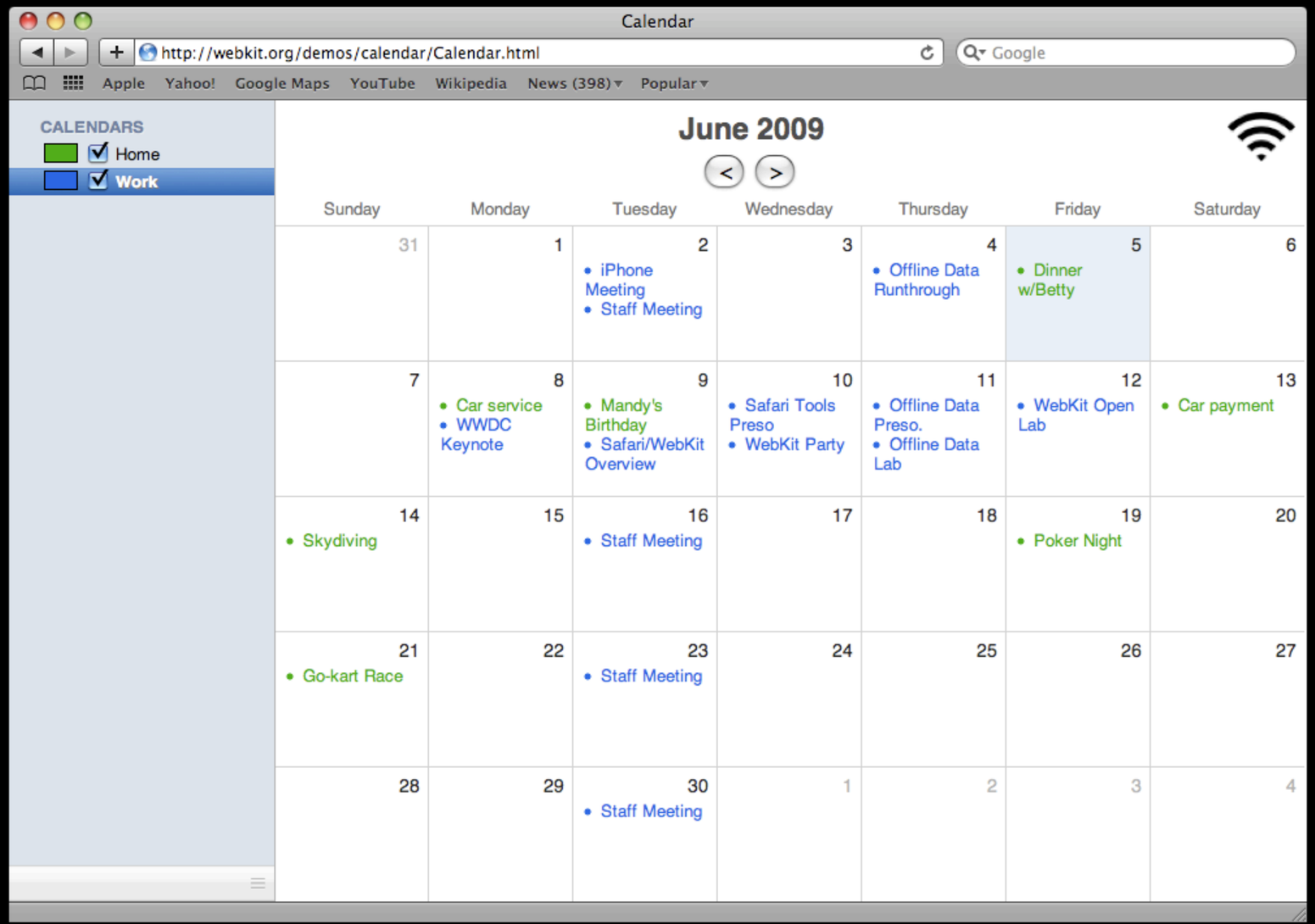
```
function errorCallback(SQLTransaction tx, SQLError error)
{  ...  }
```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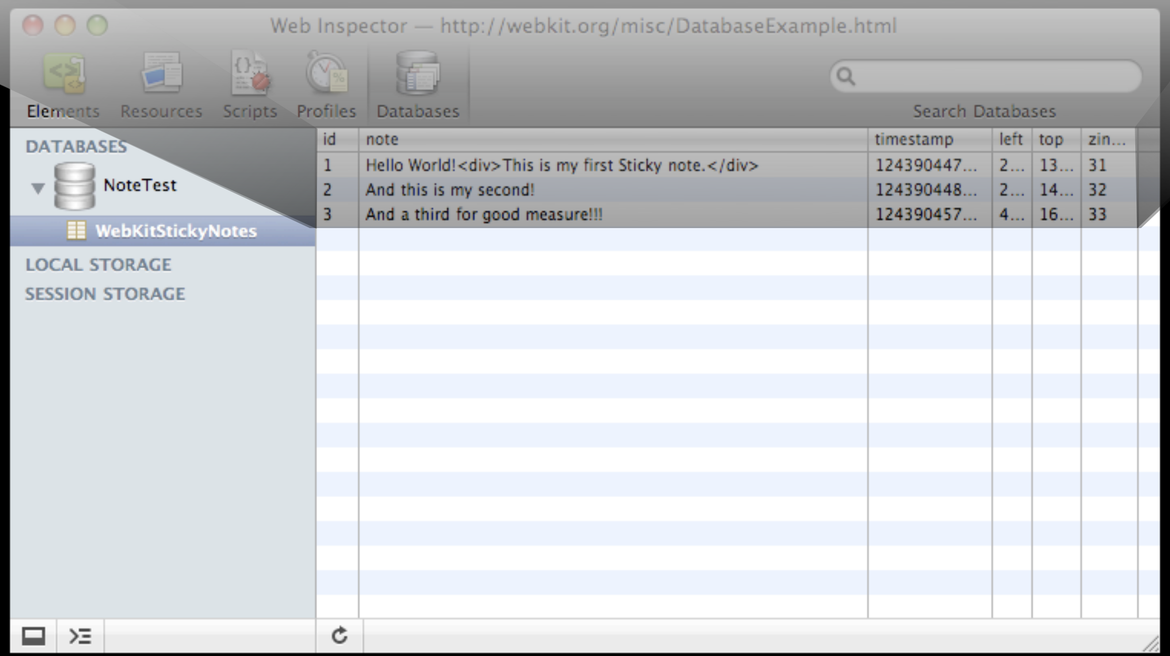
26
27
28
29
30
• Staff Meeting
1
2
3
4

WebKit HTML 5 SQL Storage Notes Demo
http://webkit.org/misc/DatabaseExample.html
Google
New Note
Hello World!
This is my first Sticky note.
Last Modified: 2009-6-1 1
And this is my second!
Last Modified: 2009-6-1 18:
And a third for good measure!!!
Last Modified: 2009-6-1 18:2:58

id	note	timestamp	left	top	zin…
1	Hello World! This is my first Sticky note.	124390447…	2…	13…	31
2	And this is my second!	124390448…	2…	14…	32
3	And a third for good measure!!!	124390457…	4…	16…	33



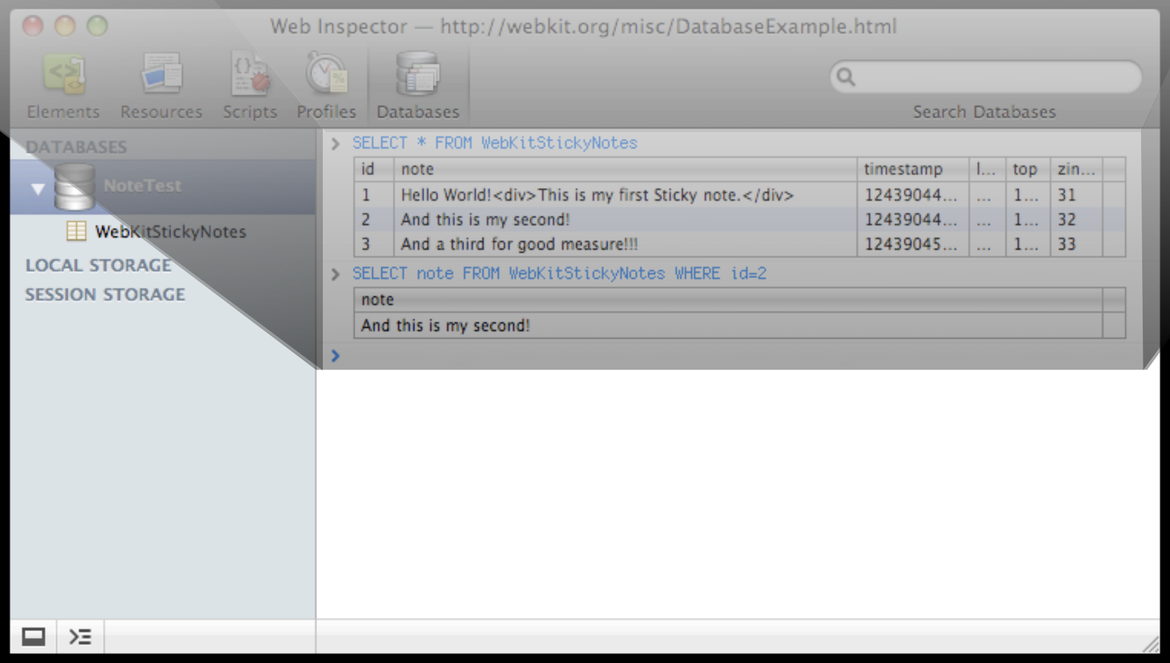
```
> SELECT * FROM WebKitStickyNotes
```

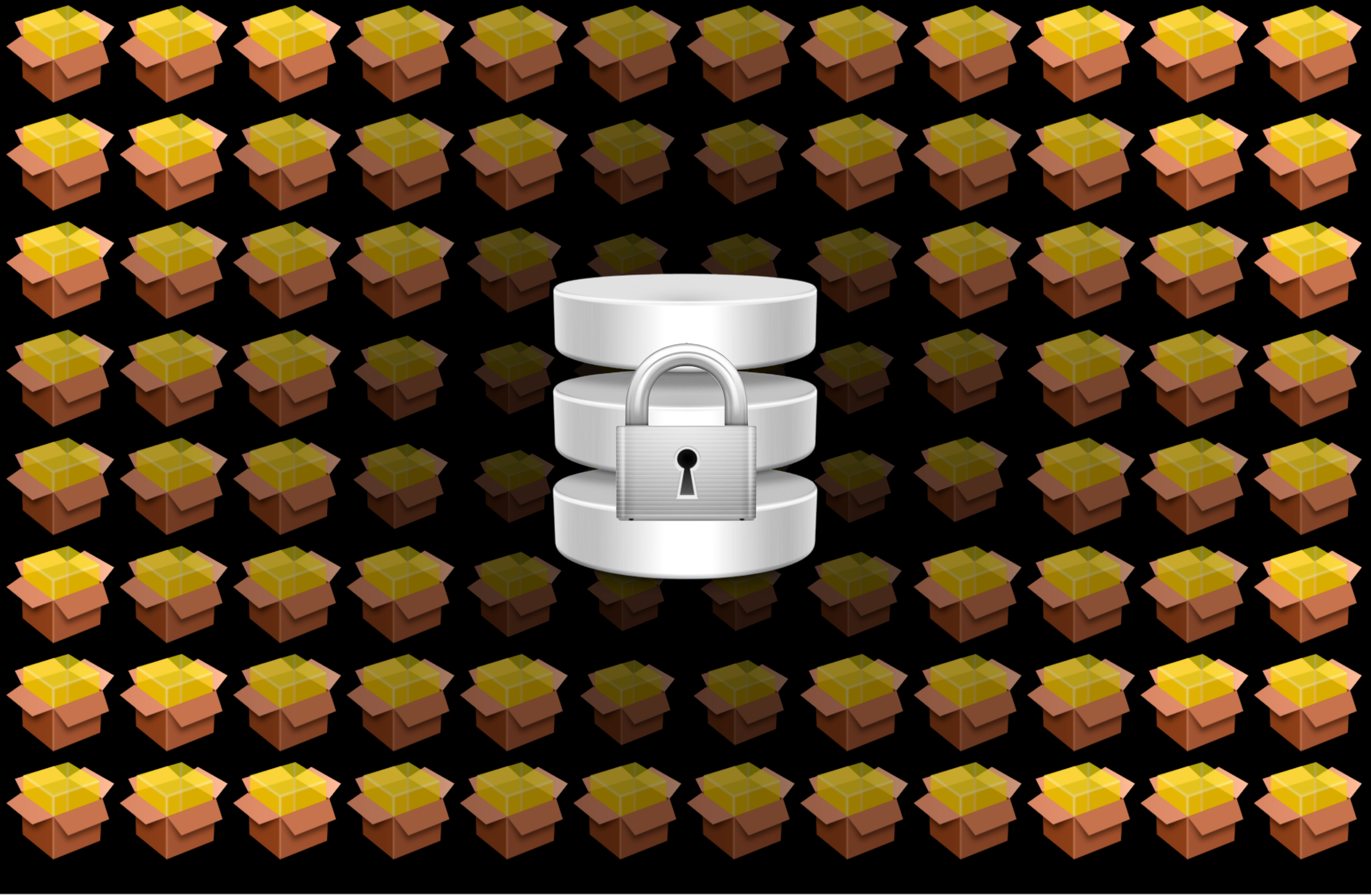
id	note	timestamp	l...	top	zin...	
1	Hello World! This is my first Sticky note.	12439044...	...	1...	31	
2	And this is my second!	12439044...	...	1...	32	
3	And a third for good measure!!!	12439045...	...	1...	33	

```
> SELECT note FROM WebKitStickyNotes WHERE id=2
```

note	
And this is my second!	

```
>
```





Wow, what else can I store offline?

What We'll Talk About

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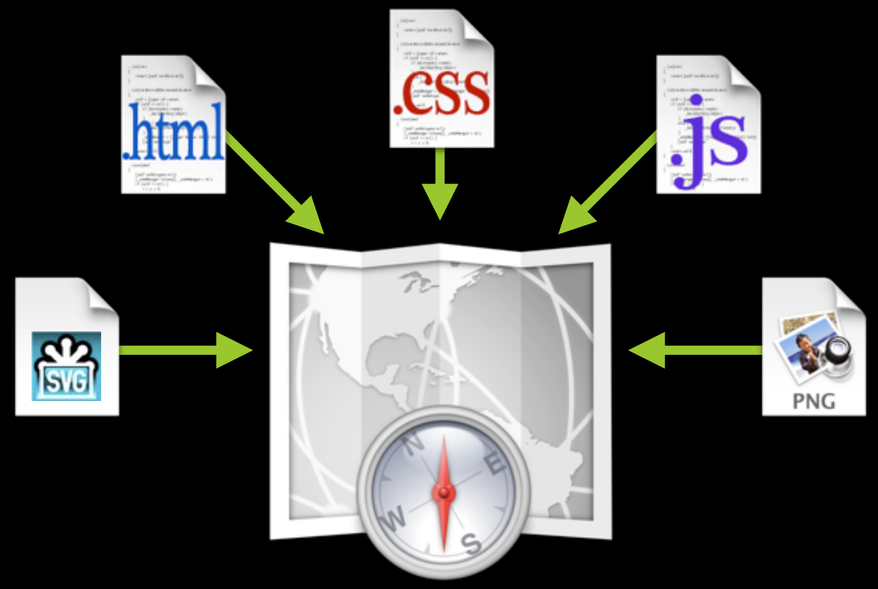
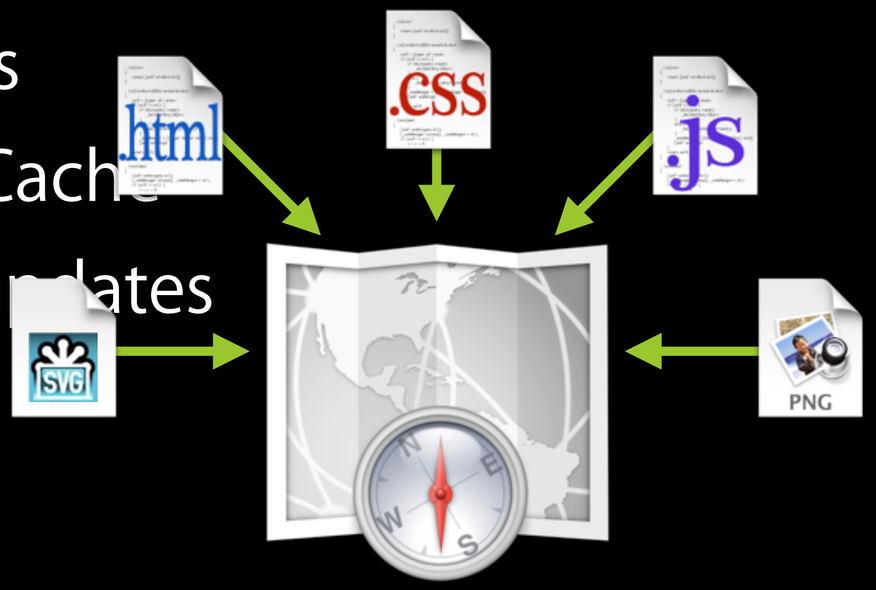
- HTML 5 key/value storage
- HTML 5 structured databases
- HTML 5 application cache



Application Cache

Overview

- Store entire application offline
- Manifest of resources
- window.applicationCache
- Automated atomic updates
- Online/offline status



Application Cache

Resource manifest

- Text file
- List of every URL in your application
- Two types of entries
  - Explicit entries
  - Online whitelist entries

Application Cache

Resource manifest example

```
CACHE MANIFEST

CACHE:
index.html
http://www.offlinecheckers.com/resources/Checkers.js
resources/Checkers.css
resources/GameBoard.png
http://www.hardworking-developers.com/SelfPortrait.png

NETWORK:
# Online whitelist entries
```

Application Cache

Resource manifest example

```
CACHE MANIFEST

CACHE:
# Explicit entries

NETWORK:
images/dynamic-changing-image.png
dynamic-mail-feed.html
cgi/some-XHR-resource.xml
```

Application Cache

Specifying your resource manifest

```
<html>
```

```
<html manifest=”OfflineCheckers.manifest”>
```

Application Cache

Specifying your resource manifest

```
<html manifest=”OfflineCheckers.manifest”>
```

Application Cache

Setting up your server

- In your Apache's mime.types file:

```
text/cache-manifest    .manifest
```

Application Cache

Loading process

1. Resources are loaded from the local cache
2. Manifest file refetched in the background
3. If it has changed, new resources are fetched as necessary

- When the update is complete:
  - You can swap versions of the application in place…
  - …or the next time your user visits they'll get the new version

Application Cache

Performing atomic updates

```
window.applicationCache.onupdateready = yourReadyHandler();

function yourReadyHandler() {
    window.applicationCache.swapCache();
}
```

Application Cache

Performing atomic updates

```
window.applicationCache.onupdateready = yourReadyHandler();

function yourReadyHandler() {
    window.applicationCache.swapCache();
}
```

Application Cache

Other progress events

```
applicationCache.status;

applicationCache.onchecking = yourCheckingHandler();
applicationCache.onnoupdate = yourNoUpdateHandler();
applicationCache.onerror = yourErrorHandler();
applicationCache.ondownloading = yourDownloadingHandler();
applicationCache.onprogress = yourProgressHandler();
applicationCache.onupdateready = yourReadyHandler();
```

Application Cache

Online/offline status

```
window.navigator.onLine;
...
window.addEventListener('offline', yourOfflineHandler, false);
window.addEventListener('online', yourOnlineHandler, false);
...
function yourOnlineHandler() {
    applicationCache.update();
}
```

Application Cache

Online/offline status

```
window.navigator.onLine;
...
window.addEventListener('offline', yourOfflineHandler, false);
window.addEventListener('online', yourOnlineHandler, false);
...
function yourOnlineHandler() {
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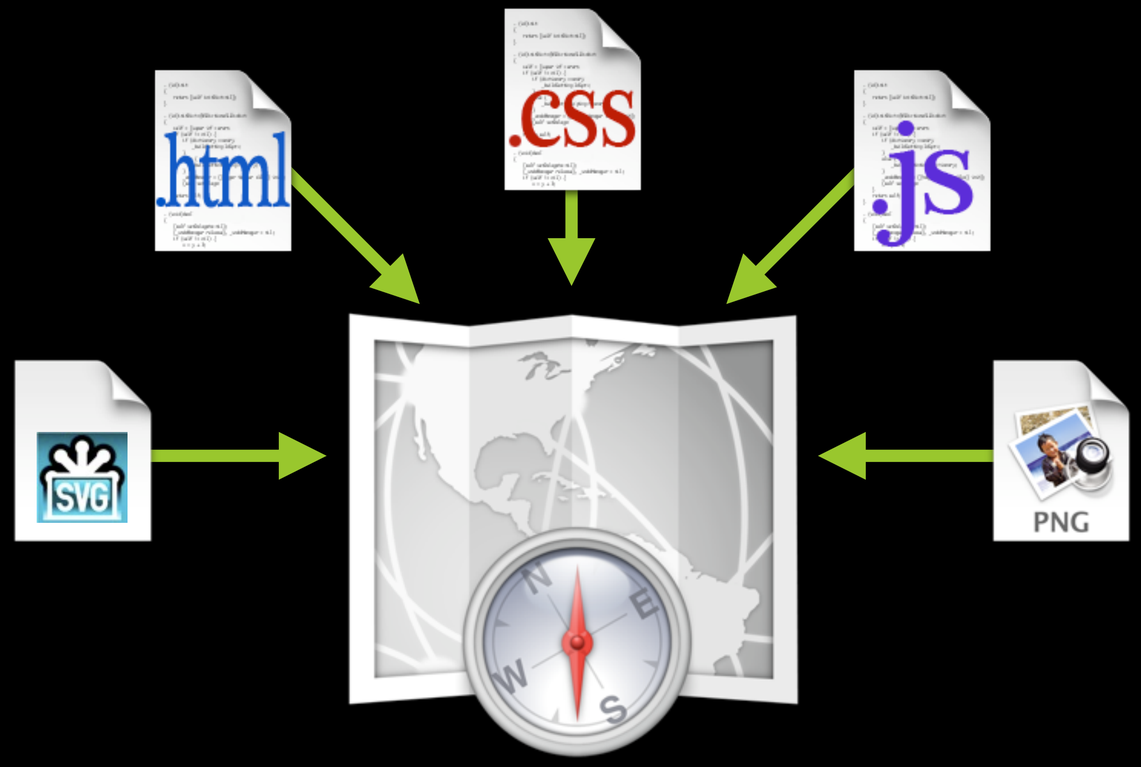
}
```


.html
.css
.JS
SVG
PNG
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Demo

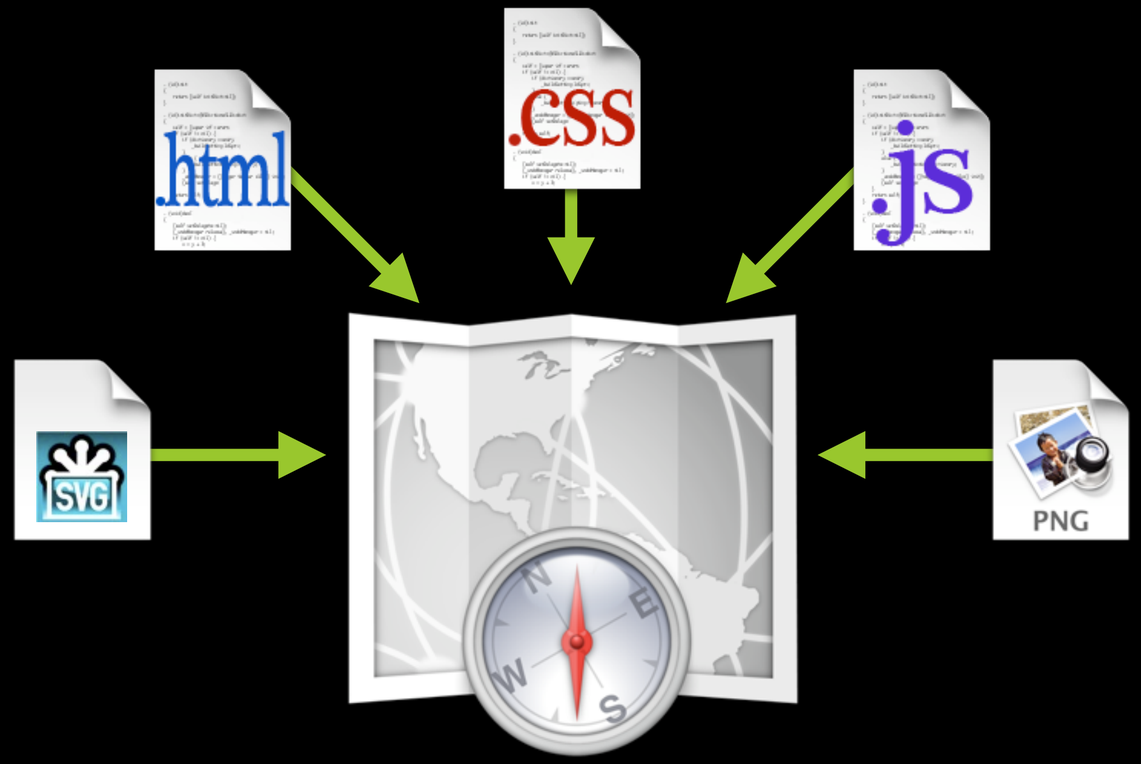
Offline Checkers

Beth Dakin
Safari and WebKit Engineer

Application Cache

Offline Checkers Demo

- Works offline
- Speeds online loading
- Few steps to add to existing application


.html
.css
.js
SVG
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More Information

HTML 5 Application Cache Specification
http://www.whatwg.org/specs/web-apps/current-work/

HTML 5 Key/Value and Database Storage Specification
http://dev.w3.org/html5/webstorage/

WebKit Open Source Project
http://www.webkit.org/
#webkit on irc.freenode.net

Vicki Murley
Safari Technologies Evangelist
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Labs and Related Sessions

Local Data Storage and Offline Web Applications Lab	OS X Lab A Thursday 5:00PM
Building Compatible Websites Using Emerging Web Technologies	Russian Hill Thursday 5:00PM
WebKit Lab	OS X Lab D Friday 12:00PM

Q&A

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WWDC09